

Americus, Sumter county, Georgia: on the night of the 29-30th a severe wind and rain storm passed over this place; trees and fences were blown down and corn broken off; much damage was done to mill property and county roads.

Savannah, Georgia, 30th: the continued heavy rains of the last days of the month have seriously injured the crops in Clarke county. The streams of Oglethorpe county were higher than has been known in years. In Sumter county the corn crop was much injured by wind, it being estimated that one-half was broken off. Bottom lands were overflowed, and crops completely destroyed.

Eastman, Dodge county, Georgia: the heavy rain of the 30th did much damage in this county. Bridges and grist mills on water courses were washed away, and crops greatly injured.

Sofkee, Decatur county Georgia: on the 30th this section was visited by a destructive rain and wind storm. Rain began falling early in the morning and continued during the day, it was especially heavy from 3 to 5 p. m., when it was accompanied by a severe northeast gale. All mills using water as a motor were partly destroyed, fences were blown down or crushed by falling timber, and bridges were carried away by the freshet. The roads were badly washed and blocked with trees and debris. The storm was especially severe on growing crops; cotton and corn were beaten to the ground and submerged in mud; peach and pear trees were blown down by thousands and much ripe fruit destroyed.

Grand Coteau, Saint Landry parish, Louisiana, 30th: during the month the amount of rainfall was about double the average for June, and considerable damage to crops was done by the overflow of streams.

Spartanburg, Spartanburg county, South Carolina, 30th: the month has been very rainy, causing floods in the lowlands and injury to crops.

STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for June, 1886, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, June, 1886.
[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29.9	1	4.8	14	1.8	3.0
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22.0	26	6.6	6	2.6	4.0
Little Rock, Arkansas.....	23.0	16	8.9	10, 11	2.8	6.1
<i>Missouri River:</i>						
Yankton, Dakota.....	24.0	21	22.9	1	16.6	6.3
Omaha, Nebraska.....	18.0	11, 12	12.9	30	10.1	2.8
Leavenworth, Kansas.....	20.0	21, 24	14.3	1	9.3	5.0
<i>Mississippi River:</i>						
Saint Paul, Minnesota.....	14.5	20	6.3	11, 12	3.3	3.0
La Crosse, Wisconsin.....	24.0	27, 28	6.5	15, 16	4.9	1.6
Dubuque, Iowa.....	16.0					
Davenport, Iowa.....	15.0					
Keokuk, Iowa.....	14.0	1	7.8	22 to 25	3.9	3.9
Saint Louis, Missouri.....	32.0	28	20.6	8, 9	15.0	5.6
Cairo, Illinois.....	40.0	30	29.6	10, 11	20.3	9.3
Memphis, Tennessee.....	34.0	1	24.2	12, 13	16.0	7.6
Vicksburg, Mississippi.....	41.0	1	41.9	19	25.4	15.5
New Orleans, Louisiana.....	13.0	2 to 8	14.4	19	11.8	2.6
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22.0	18	11.3	2, 3, 4	2.0	9.3
Cincinnati, Ohio.....	50.0	30	25.0	11	9.5	15.5
Louisville, Kentucky.....	25.0	30	10.3	14	5.7	4.0
<i>Cumberland River:</i>						
Nashville, Tennessee.....	40.0	27	23.0	1, 2	5.1	17.9
<i>Tennessee River:</i>						
Chattanooga, Tennessee.....	33.0	23	16.0	30	7.2	8.8
<i>Monongahela River:</i>						
Pittsburg, Pennsylvania.....	29.0	18	11.3	2, 3, 4	2.0	9.3
<i>Savannah River:</i>						
Augusta, Georgia.....	32.0	8, 9	19.4	4, 5	8.9	10.5
<i>Mobile River:</i>						
Mobile, Alabama.....		15	8.6	2, 3	17.3	1.5
<i>Sacramento River:</i>						
Red Bluff, California.....		1, 5	3.2	22 to 30	2.4	0.8
Sacramento, California.....		1, 2	20.8	30	13.9	6.9
<i>Willamette River:</i>						
Portland, Oregon.....		9, 10	20.0	30	14.0	6.0
<i>Colorado River:</i>						
Yuma, Arizona.....		6, 7	26.7	30	20.0	6.7

HIGH TIDES.

Chincoteague, Virginia, 15th.
Cedar Keys, Florida, 21st.
Manatee, Florida, 29th.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Tatoosh Island, Washington Territory: an aurora was observed at 8.40 p. m. of the 1st, consisting of a pale straw-colored light, extending from 5° east to 26° west of the magnetic meridian.

Fort Buford, Dakota, 2d: an aurora began at 10.50 p. m., consisting of four streamers of a reddish hue, extending to about 50° altitude, and from 360° to 35° azimuth. The streamers appeared to be stationary, and were at their maximum intensity between 11 and 11.15 p. m., after which they gradually faded and disappeared at 11.35 p. m.

Saint Vincent, Minnesota: at 10 p. m. of the 4th an aurora was observed in the northern sky. It consisted of a horizontal band of straw-colored light extending from northwest to northeast and resting on a dark segment. The light was about 16° in altitude and presented an undulating appearance. The display was not active and remained as first observed until the early morning of the 5th, when it disappeared.

Harvard College, Cambridge, Massachusetts: on the 4th an auroral arch became visible as soon as the twilight had disappeared. The aurora became quite distinct at 9 p. m., streamers appearing at 9.15 p. m., some of which were very long and bright.

Duluth, Minnesota, 4th: a pale straw-colored auroral light was observed from 9.40 p. m. until about midnight. Average altitude of the aurora was 30°, azimuth, 150° to 250°.

Gardiner, Kennebec county, Maine: a faint aurora was seen at 9 p. m. of the 4th. It became brighter at 10 p. m., but was nearly obscured by clouds; at midnight a bright arch was seen with streamers nearly extending to the zenith.

Mount Washington, New Hampshire: at 9.20 p. m. of the 4th a faint auroral light was seen, extending from 50° west to 60° east of north. The aurora increased rapidly in brilliancy and extent; at 9.30 p. m. the arch extended from 70° west to 80° east of north, and to an altitude of 12°, at the same time brilliant white fleecy streamers rose rapidly from the arch. The maximum brilliancy occurred at 10.10 p. m., after which the light gradually faded and disappeared at 11.50 p. m.

Eastport, Maine: a brilliant auroral display was observed from 7.35 to 10.10 p. m. of the 4th. The arch was 45° in altitude and extended about 140° along the horizon; waves of white light shot up from the borders of the arch towards the zenith, making an illumination strong enough to cast a shadow. The aurora was at its maximum brilliancy at 9.30 p. m.

Washington City, District of Columbia: an aurora was seen at 9.53 p. m. of the 4th. It was first noticed as two bright areas of light in the north with a dark space between. The altitude was about 30° and the width 20° on either side of the north point of the horizon. The western portion had an appearance of streamers which gradually moved eastward across the dark space and finally coalesced with the eastern portion of the aurora. The display ceased at 9.59 p. m.

Boston, Massachusetts, 5th: An aurora was visible from 8.45 to 10.45 p. m. The beams were well-defined and were from one to two degrees in breadth; at times they became very bright, changing from a pale yellow to light red. Altitude of aurora, 25°; azimuth, 120° to 240°.

Fort Buford, Dakota: a white auroral light was observed from 12.58 until 2.10 a. m. of the 5th, extending to about 20° altitude and 45° azimuth. The light was irregular in form and at the period of maximum brilliancy a few streamers of reddish tinge were visible.

Marquette, Michigan: a pale auroral light was seen from 10.25 to 10.50 p. m. on the 5th. Streamers of various heights were observed, several extending to the zenith.

Duluth, Minnesota: a pale green auroral light was observed from 11 p. m. of the 6th until 1 a. m. of the 7th. No motion or beams were noted, but a steady light extending to an altitude of 20°.

Grand Haven, Michigan: at 10.58 p. m. of the 24th two broad, rose-colored streams of auroral light were observed in the northern sky, issuing from behind heavy cumulus stratus clouds. At 11.15 p. m. the sky had become entirely overcast and the aurora was hidden from view.

Grand Haven, Michigan: at 11.40 p. m. of the 25th an aurora was observed which continued until 11.35 p. m. It extended from azimuth 135° to 220°, and reached an altitude of 40°.

Port Huron, Michigan, 29th: a faint aurora, of 15° altitude and 60° azimuth, was observed from 9.55 to 11.30 p. m. It consisted of a dark base upon which rested a bright arch of diffused white light, resembling the morning twilight. The display was at its maximum brilliancy at 10.30 p. m., after which it gradually faded and entirely disappeared at 11.30 p. m.

Boston, Massachusetts: an auroral arch, of pale straw color, was observed from 8 p. m. of the 29th until 3.30 a. m. of the 30th. Altitude, 20°; azimuth, 150° to 220°.

Oswego, New York: at 9.45 p. m. of the 29th an auroral arch, of seven degrees altitude and 90° azimuth, was observed. Beams of light extended upward to the height of 40°. The aurora continued until after midnight.

Portland, Maine: an aurora was observed from 9 p. m. until midnight of the 29th. It first appeared in the form of slender beams of light arising from an irregular arch. At 10 p. m. it was at its maximum brilliancy and had a motion from west to east. At 10.30 p. m. the aurora had faded away, but reappeared about 11 p. m. and continued until midnight.

Valentine, Nebraska: at 10.20 p. m. of the 29th an aurora was observed extending from about 15° west to 10° east of north. It consisted of a diffused straw-colored light, with indistinct streamers, extending to an altitude of 45°. The aurora increased in brilliancy and was at its maximum at 2 a. m. of the 30th, after which it gradually faded and disappeared in the early morning.

Alpena, Michigan: an aurora was seen at 9 p. m. of the 29th, consisting of a pale white light resting on a dark segment; the arch was about 90° azimuth and 30° altitude. Faint streamers shot up to an altitude of from 10° to 25°. The display continued until 3 a. m. of the 30th.

Saint Paul, Minnesota: a faint white auroral light was visible from 11 p. m. until midnight of the 29th. The illuminated space was a segment of the sky 10° in altitude at the centre and situated between 170° and 195° azimuth.

Bancroft, Kossuth county, Iowa: on the 29th a bright auroral arch was seen in the north, of 9° altitude, and extending from 135° to 225° azimuth.

Clayton, Gloucester county, New Jersey: on the 29th an aurora was observed, extending from northwest to northeast, with streamers shooting up to an altitude of 45°.

Burlington, Vermont: a brilliant aurora was observed from 8 to 10 p. m. of the 29th; the display consisted of waving beams of light which appeared between the northern horizon and the zenith.

New London, Connecticut: an auroral light was observed on the night of the 29-30th from 9 p. m. until daylight. The aurora presented a brilliant appearance at 2 p. m., when several streamers, varying in altitude and width, were seen to appear and disappear at short intervals. An aurora was also visible about 9 p. m. of the 30th.

Bismarck, Dakota: an auroral display was observed from 1 to 4.30 a. m. of the 30th. Streamers of bright yellow light ascended to an altitude of 70°. A dark segment of 10° altitude appeared at 3 a. m., the time of maximum brilliancy. The aurora disappeared at daybreak.

Duluth, Minnesota: shortly after midnight on the morning of the 30th a bright white auroral band was observed to start from azimuth 135° and pass across the sky to 10° above the

horizon at azimuth 315°. This band was about a degree in width and continued well-defined and unbroken until 12.26 a. m., when it began to fade away and was succeeded by a pale greenish light, which increased in brilliancy and gradually assumed the form of an irregular arch. The aurora was visible until daylight.

Mount Washington, New Hampshire: an auroral light was seen at 9.20 p. m. of the 30th. Very brilliant streamers rose from near the horizon and disappeared at the zenith. The maximum brilliancy occurred at 10.30 p. m., when the summit of the mountain was brightly illuminated by the display; at that time the aurora extended from a few degrees north of east to five degrees north of west. Neither arch nor dark segment were seen during the display.

Fort Buford, Dakota: a brilliant aurora suddenly appeared in the eastern sky at 11.21 p. m. of the 30th. It was of a deep orange color, changing to a greenish hue near the base, from which arose numerous streamers to an altitude of 60°. The aurora extended over 45° of azimuth and disappeared at 11.44 p. m.

Boisé City, Idaho: a pale auroral light was observed about 1.30 a. m. of the 30th, extending from the northwest to the northeast.

Auroral displays were also observed during the month as follows:

- 1st.—Pekin, Illinois.
- 3d.—Clayton, New Jersey; North Lewisburg, Ohio.
- 4th.—New Haven and North Colebrook, Connecticut; Webster, Dakota; Spiceland, Indiana; Portland, Maine; Woodstock, Maryland; Amherst, Westborough, and Fall River, Massachusetts; Moorhead, Minnesota; Nashua, New Hampshire; Setauket, New York; Garrettsville, Ohio; Block Island, Rhode Island; Tatoosh Island, Washington Territory.
- 5th.—New Haven, Connecticut; Vevay, Indiana; Portland, Eastport, and Gardiner, Maine; Cambridge and Heath, Massachusetts; Mackinaw City, Escanaba, and Traverse City, Michigan; Mount Washington, New Hampshire; Setauket, New York; Block Island, Rhode Island; Embarras, Wisconsin.
- 9th.—Poplar River, Montana.
- 11th.—Tatoosh Island, Washington Territory.
- 19th.—North Lewisburg, Ohio.
- 20th.—New Haven, Connecticut; Clayton, New Jersey; Mountainville, New York.
- 23d.—Hiram, Ohio.
- 24th.—Tatoosh Island, Washington Territory; Sandusky, Ohio.
- 26th.—Garrettsville, Ohio; Cambridge, Massachusetts.
- 27th.—Poplar River, Montana; Fort Yates, Dakota.
- 28th.—Dudley, Massachusetts.
- 29th.—North Colebrook, Connecticut; Fort Yates, Fort Totten, Huron, and Webster, Dakota; Pekin, Illinois; Vevay, Indiana; Fort Madison, Des Moines, and Independence, Iowa; Eastport, Gardiner, Orono, and Bar Harbor, Maine; Amherst, Cambridge, Somerset, and Westborough, Massachusetts; Mackinaw City and Traverse City, Michigan; Moorhead, Minnesota; Nashua and Berlin Mills, New Hampshire; Atlantic City and Beverly, New Jersey; Cooperstown, Factoryville, Ithaca, Menand, Syracuse, Palermo, and Setauket, New York; Fallsington, Pennsylvania; Newport, Vermont; Prairie du Chien, Wisconsin.
- 30th.—Huron, Fort Meade, and Webster, Dakota; Pekin, Illinois; Eastport and Gardiner, Maine; Cambridge and Blue Hill Observatory, Massachusetts; Moorhead, Minnesota; Nashua and Berlin Mills, New Hampshire; Atlantic City, New Jersey; Post Mills, Vermont; Walla Walla, Washington Territory.

THUNDER-STORMS OF JUNE, 1886 (by Jr. Prof. H. A. Hazen).

The accompanying table gives the total number of storms recorded and studied; these are given by states and districts. Of the total number, 256 were from Signal Service, 492 from voluntary, and 1,534 from special thunder-storm observers.

The days of greatest frequency were the 2d, 13th, 14th, 16th, 24th, and 25th; days of least frequency were the 3d, 4th, 5th, 11th, 29th, and 30th. A marked feature has been the falling off in the number of storms for this month as compared with May, which had 2,734. This has been due to the drought in New England and parts of the west. An interesting feature brought out by this table is the evident progress of storms from district to district, *e. g.*, in district v, days of greatest number were the 6th, 14th, 20th; in district iii they were the 9th, 16th, 24th, or about three days later; in ii and i they were the 10th, 17th, 25th, or four days later than v.

Attention of observers is invited to a form of thunder-storm which may be called "stationary." The following is a description by N. T. Blackman, of Florence, Ohio: "July 14th we had what I call an electric storm, commencing about 10 p. m. and

continuing until midnight, when all was calm. The storm came out of the northwest, and for two hours the thunder was terrific. It did not appear to travel past us, but hung right overhead for two hours, and the thunder and lightning were very severe. The last thunder was about midnight, and right overhead." Several records of this kind have been received, and it is hoped that observers will take particular pains to record those storms which do not appear to advance. It seems probable, from a slight investigation, that such storms occur very near the centre of low areas which have an exceedingly small motion of translation.

Attention is again directed to the point that it is exceedingly difficult to obtain the quarter from which a storm is coming while in the house, and special effort is desired that the direction of the storm be carefully determined.

Thunder-storms by districts, June, 1886.

District.	State.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	Total.	
I	Connecticut							1			2			1	3											3	1						11
	Maine		1	1				1			1	2														3				1			10
	Massachusetts										2					1	3									10	9	1					23
	New Hampshire				1						1																		1				4
	New York			9					8			2				2	1	2	7	1						12	1						45
	Rhode Island																										1						1
	Vermont								4				1														2	1					3
Total			10	2				14		1	7	3		1	5	2	2	7	1							27	17		1	1	1		102
II	Delaware										1	3				4			3					1		2	4						18
	Maryland															6			7							5	1						20
	New Jersey				1																								2	4	2	3	38
	North Carolina				2			2	5	3	5							2	3							1	3	1					37
	Pennsylvania							1			1	6				1	5		1	4						3	9	2					78
	Virginia							6	4	9	6			4	5	1			5							2	1	14	6				9
	West Virginia				2					1	1				1												1	3					7
Total			5	7	1		1	8	9	15	21		6	23	1	3	25							4	1	21	30	4	5	5	2	3	200
III	Illinois		8	5		2	1	5	2	5			3	11	8	11	6					1	15	8	4	1	3	3	3				105
	Indiana		2	9				1	6	1					8	3	3	1				1		2	5	4	3	3	2		1		50
	Kentucky																															3	
	Ohio		7	157	9	2	7	7	1	5	52	23	8	4	109	21	37	97	21		1	41	3	6	40	124	109	10	2		1		904
	Tennessee		5	4	3			1	2	7	6	3	1		7	2	2	3			1	5		3	5	2		1	7				70
Total			22	175	12	2	10	9	9	15	70	27	9	7	136	34	53	109	22		2	47	4	20	55	134	113	17	15	3	2		1,142
IV	Michigan		2	1		1	2	5	1		1		3	5		2	11	7	2			1	4	5	5	7	4	2					71
	Minnesota		1			2				2			1	3	1	5					2	2	3										29
	Wisconsin		4			1											4	2					3	3	4		2		3	1			27
Total			7	1		4	2	5	1	2	1		4	8	1	7	15	13	2		2	6	10	9	5	10	4	7	1				127
V	Dakota							2	5	4	1	1	7	3	1	6		3	2	7	5						1	1	1				57
	Iowa		24	4	1	15	10	54	5	15	4	1		9	12	78	15	49	1	16	9	36	35	7	12	4	3	12	28	30		3	846
	Nebraska		1					4	3	1			4	3	3	5	5	2		6	1	1	3		1	2	3		5	2			56
Total			25	4	2	15	10	60	13	20	5	2	11	15	16	89	21	54	3	29	15	39	35	7	13	7	4	13	34	32		3	599
VI	Arkansas			2						2	2	1			2	2	1					3	1					2			1		20
	Indian Territory		1	1				1										1	1														7
	Kansas		16					5		5	1			4		3	7	13	4	9	5	3	7	1		2	5	9	2	5	2		108
	Missouri		22	3				1	1	2	2	1	1	4	1	5	3	8		1	3		1	3			5	4	3	1			75
Total			39	6				7	1	9	5	2	1	10	3	9	11	22	4	11	11	4	8	5		2	10	13	7	6	4		210
Grand total			93	201	23	22	22	82	46	55	97	59	25	40	163	167	103	203	63	41	30	96	60	51	77	174	186	71	63	47	9	6	2,380

CHART OF ELECTROMETER READINGS.

The first diagram of chart vi shows some of the results of simultaneous observations made at the Smithsonian Institution and at the office of the Chief Signal Officer. The distance between the two stations is slightly over one mile. The exposure at the office is that described in the MONTHLY WEATHER REVIEW for April. That at the Smithsonian Institution is from the north window of a tower on the north side of the building, the height of the collector above the ground being about fifty feet. The diagram shows observations made at both stations during the passage of a thunder-storm on June 17, 1886.

The morning was fair, with few cirro-stratus clouds moving from sw; wind sw., barometer low, and, at 9 a. m., a thunder-storm was predicted for the afternoon. The electrometer readings at the Signal Office were positive until 2.50 p. m., when they became negative. The wind was nw. and the weather threatening; rain beginning at 2.50 p. m.; ending in about one minute. Heavy rain began at 2.58, and at 3.44 the weather was clearing. At 3.38 the electrometer indications became positive in character and continued so until the last observa-

tion at 6 p. m. The values were greatest immediately after the passage of the storm.

The following notes were made at the Smithsonian Institution during the observations:

June 17, 1886:

3.21 10 p. m., lt. rain; distant thunder; wind nw., lt.
 3.23 04-09 p. m., distant thunder; heavy rain.
 3.25 13-28 p. m., thunder (near).
 3.28 16-52 p. m., thunder.
 3.34 20, 3.34 30-50 p. m., the first time, that of very vivid lightning-flash in the east; the second, that of the thunder and its duration.
 3.43 30-48 p. m., thunder; wind s., light.
 3.57 p. m., rain ended; storm far off in east.

The second diagram of chart vi represents a series of simultaneous observations made at the Signal Office and at the top of the Washington Monument—the distance between the two stations being about 3,500 feet, and the elevations respectively 45 and 500 feet above the ground. The observations were taken every five minutes, except between 11.30 a. m. and 12 m., and 1.30 p. m. and 2 p. m., when the interval was a minute. The day was a beautiful one, with the wind light,

from the northwest, a slight haziness, and a few small whitish cumulus clouds. There were hardly any noticeable changes throughout the day in these conditions. Compared with a series of observations made a few days previous (July 17th) the curve for the monument is remarkably quiet and even. On the date mentioned, the sky being cloudless and hazy, the wind from the sw., and no indication of rain, the values obtained exceeded at times 3,000 volts in a positive direction and averaged for the whole forenoon half this value, the needle oscillating almost continually. In the afternoon the indications were more steady and even, the values ranging under 1,000 volts. July 20th was a date on which no especial electrical activity might have been expected, and the curves in their general character show about as close a correspondence as might be looked for.

The third diagram represents the results of observations made during the passage of a thunder-storm at Ithaca, New York (the physical laboratory of Cornell University). The exposure at this place is such that in fair weather the average indications exceed 600 volts, while in stormy weather changes of more than 2,000 volts occur. On June 25th, in the early part of the forenoon, light showers occurred to the s. and sw. of the place of observation. The indications were steadily negative. At 5.30 p. m. dark cumulus clouds came up from the nw., wind light, and distant thunder audible. Here, as elsewhere, was noticed the sudden movement of the needle simultaneous with the flash of lightning. Rain commenced at 6.07 p. m.; heavy rain in a few minutes. The following abbreviated table is from the observer's notes:

June 25, 1886:	
6.05 00 p. m., thunder.	6.24 45 p. m., sudden increase in rain.
6.06 14 p. m., lightning.	6.27 10 p. m., lightning.
15 p. m., thunder.	6.27 15 p. m., thunder.
6.07 20 p. m., lightning.	6.28 15 p. m., lightning.
6.08 00 p. m., thunder.	6.28 35 p. m., thunder.
6.08 20 p. m., lightning.	6.29 00 p. m., lightning.
6.09 00 p. m., heavy rain; torrents.	6.30 50 p. m., lightning.
6.10 15 p. m., lightning.	6.31 30 p. m., lightning; distant thunder.
6.10 20 p. m., thunder.	6.32 20 p. m., lightning.
6.11 50 p. m., lightning.	6.00 45 p. m., lightning.
6.12 35 p. m., lightning.	6.33 00 p. m., thunder.
6.13 00 p. m., thunder.	6.33 35 p. m., a clinking sound heard in electrometer, probably sparking.
6.13 10 p. m., lightning.	6.34 05 p. m., ditto.
6.13 55 p. m., thunder.	6.35 00 p. m., needle not oscillating.
6.14 10 p. m., lightning.	6.36 00 p. m., lightning.
6.14 50 p. m., lightning.	6.36 05 p. m., thunder.
6.15 30 p. m., lightning.	6.36 30 p. m., rain diminishing.
6.15 55 p. m., lightning.	6.38 20 p. m., lightning; clinking in electrometer.
6.16 15 p. m., thunder.	6.39 10 p. m., thunder distant.
6.16 35 p. m., lightning.	6.40 00 p. m., needle steady.
6.17 00 p. m., lightning.	6.41 00 p. m., light rain.
6.17 05 p. m., thunder.	6.42 00 p. m., storm past, but a dark cloud arising in southwest.
6.17 35 p. m., lightning.	6.43 00 p. m., distant thunder.
6.17 45 p. m., thunder.	6.43 20 p. m., lightning; distant thunder.
6.18 10 p. m., lightning.	6.43 40 p. m., distant thunder.
6.18 25 p. m., thunder.	6.46 00 p. m., clearing up in west.
6.18 56 p. m., lightning.	6.47 00 p. m., dark cloud, sw., 2 miles; storm now in e.
6.19 07 p. m., thunder.	6.48 00 p. m., thunder very distant.
6.19 25 p. m., lightning.	6.48 20 p. m., lightning.
6.19 45 p. m., lightning.	6.48 40 p. m., thunder.
6.20 00 p. m., thunder.	6.49 00 p. m., rain ended.
6.20 37 p. m., lightning.	6.50 00 p. m., dark cloud in ssw.
6.20 50 p. m., thunder.	6.52 40 p. m., lightning.
6.21 00 p. m., thunder.	6.52 50 p. m., thunder; raining in ssw.
6.21 40 p. m., lightning.	7.00 00 p. m., distant thunder.
6.21 45 p. m., thunder very loud.	7.02 30 p. m., distant thunder.
6.22 14 p. m., lightning.	7.17 00 p. m., last thunder heard.
6.22 35 p. m., lightning.	7.20 00 p. m., very light rain and rain-bow.
6.22 50 p. m., thunder.	
6.23 00 p. m., lightning.	
6.23 09 p. m., thunder.	
6.23 20 p. m., lightning.	
6.23 40 p. m., thunder.	
6.24 10 p. m., lightning.	
6.24 20 p. m., thunder.	

Observations at the summit of the Washington Monument (elevation 500 feet) during a thunder-storm.

July 14th, 1886, in the early part of the afternoon a thunder squall came up suddenly; at 2.45 p. m. the sky was covered

with a pallium of stratus clouds, and distant thundering was audible; darker cumulus clouds came rapidly from the west, and by 3.15 p. m. the storm was overhead; two very vivid lightning flashes, with sharp and loud thunder, occurred about this time; at 3.40 p. m. the storm had passed. The collector was exposed from window on the south side, the height above the ground being about five hundred and five feet. When connected with the collector the needle was greatly excited, moving from one side to the other rapidly. The greatest deflection noticed showed a negative potential equivalent to about 3,000 volts. Sparks, however, were constantly passing between the wire-suspending fibre and the neck of the brass top-plate of the electrometer. In addition to the rapid oscillatory movements of the needle there was an up-and-down-jumping disturbance. As it was impossible to do anything with electrometer as then arranged, the wire connecting it with the collector was removed and a wire connected with the ground, held about $\frac{1}{2}$ inch away from the side of the collector. Sparks passed continuously at a rate of about 10 to 15 per second. By measurement the length of the spark was $\frac{5}{8}$ inch. There were two intense lightning flashes about 3.10 p. m. seemingly in close proximity to the monument. Simultaneously with the lightning the following phenomena were noticed: 1st, An alteration in the character of the stream of water issuing from the nozzle of the collector. Previous to the flash, and apparently depending upon the degree of electrification, the stream would be twisted and split into many fine threads and sprays; but instantly, with the occurrence of the flash, the stream resumed its normal character, maintaining it for a few seconds and then gradually becoming more and more distorted until the occurrence of another flash, when the same state of things was repeated. 2d, There was noticed a cessation of the sparking between the collector and the ground wire, simultaneously with the flash. Then long before thunder was heard (in one case eight seconds) the sparking would again begin and increase rapidly. At 3.40 p. m. the storm appeared to be over, and at this time the electrometer indications were positive and much more constant.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos were observed in the various states and territories during the month, as follows:

Alabama.—Mobile, 26th.
Arizona.—Yuma, 3d; Prescott, 10th.
Arkansas.—Lead Hill, 3d.
Colorado.—Montrose, 20th, 29th.
Connecticut.—New Haven, 1st.
Dakota.—Webster, 19th; Fort Buford, 25th, 29th.
District of Columbia.—Washington City, 21st.
Florida.—Key West, 10th, 12th, 23d; Archer, 10th, 15th, 21st, 29th.
Georgia.—Atlanta, 2d.
Idaho.—Boisé City, 13th.
Illinois.—Cairo, 6th; Riley, 8th, 10th, 19th; Springfield, 19th; Chicago, 28th; Pekin, 30th.
Indiana.—Jeffersonville, 6th; Vevay, 12th, 19th, 25th; Indianapolis, 15th; Greencastle, 16th.
Iowa.—Cedar Rapids, 2d, 5th; Keokuk and Davenport, 19th; Corydon, 27th.
Kansas.—Wakefield, 3d.
Kentucky.—Frankfort, 6th.
Maine.—Portland, 9th, 14th, 22d; Cornish, 9th, 22d.
Maryland.—Baltimore, 20th, 21st.
Massachusetts.—Amherst, 1st; Blue Hill Observatory, 1st, 11th, 22d.
Michigan.—Escanaba, 6th; Grand Haven, 7th.
Minnesota.—Saint Vincent, 24th.
Missouri.—Saint Louis, 3d.
Montana.—Poplar River, 7th.
Nebraska.—Valentine, 10th; De Soto, 26th.